Title: **ADJUSTABLE SUPPORT FRAME FOR IMAGE OUTPUT APPARATUS**

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Cross Reference to Related Applications

[0001] This application claims priority of Taiwan Patent Application Serial No. 091133638 filed on November 18, 2002.

Field of Invention

[0002] The present invention relates to an adjustable support frame for adjusting the height of the image output apparatus.

Background of the Invention

[0003] Image output apparatuses are necessary in an age emphasizing video/audio effects. For the image output apparatuses, such as projectors or epidiascopes, to adapt to different usage environment, the height adjustability of the display image is required.

[0004] Typically, conventional image output apparatuses have devices for adjusting the height. Most common adjusting devices include a plastic-wrapped screw, and the height is adjusted by rotating the screw. But such designs have a few defects as follows. The first one is that if all components are embodied as a single module, the corresponding size becomes larger thus occupying more room within the image output apparatus, or making the profile size larger. The second one is that the user may have to adjust the height with both hands. The third one is that the screw may not act smoothly as desired.

Summary of the Invention

[0005] The present invention is intended to adjust height of the image output apparatus steplessly with a relatively simple and small-size structure, thus facilitating the easy installment and saving more room. And the user may operate the apparatus smoothly using one hand pressing the image output apparatus.

[0006] One aspect of the present invention provides a support frame of an image output apparatus for adjusting height of the image output apparatus.

[0007] Another aspect of the present invention provides a support frame of an image output apparatus, occupying less room and acting smoothly. And the user may adjust height of the image output apparatus with single hand.

[0008] The present invention provides a support frame including a first positioning unit coupled to the housing of an image output apparatus, and a supporting foot. The first positioning unit is a damping wheel. The damping wheel is allowed to rotate in only one direction. When the damping wheel pushes against a side of the supporting foot and forms a positioning state, the supporting foot is static to the housing. When the housing is pressed downward, the wheel rotates to make the supporting foot move relative to the housing for adjusting height of the image output apparatus. The damping wheel may be a roller, a gear, or the like. The side of the supporting foot is a surface able to form a positioning state with the damping wheel, such as a positioning surface, a rack, or the like. The present invention further includes a coupling unit, and the damping wheel is coupled to the coupling unit.

[0009] The adjustable support frame according to the present invention further includes an apparatus by which the coupling unit horizontally moves relative to the housing. The apparatus may be a spring, a sliding railway apparatus, a gear apparatus, or similar apparatus. In a preferred embodiment, the apparatus refers to a spring, which provides the coupling unit with resilience as the coupling unit horizontally moves relative to the housing.

[0010] The adjustable support frame according to the present invention further includes an apparatus by which the supporting foot vertically moves relative to the housing. The apparatus may be a spring, a sliding railway apparatus, a gear apparatus, or similar apparatus. In a preferred embodiment, the apparatus refers to a spring, which provides the supporting foot with resilience as the supporting foot vertically moves relative to the housing.

[0011] The adjustable support frame according to the present invention further includes a separating apparatus. When the housing is pressed downward, the separating apparatus is triggered to drive the damping wheel to separate from the supporting foot. The separating apparatus may be an apparatus, for example a wedge-shaped device with an appropriate angle, for translating any pressed force into a horizontal one.

Brief Description of the Drawings

[0012] To explain the principle of the present invention, schematic diagrams of embodiments are attached and briefly described as follows. Similar notation numbers across different drawings represent similar elements.

[0013] Fig. 1(a) depicts an appearance of assembly of an embodiment in accordance with the present invention with an image output apparatus.

[0014] Fig. 1(b) depicts a cross-sectional view dissected along line I - I of Fig. 1(a).

[0015] Fig. 1(c) depicts another embodiment of a damping wheel and a side of a supporting foot in accordance with the present invention.

[0016] Fig. 2 depicts a supporting foot having a maximum length exposed in accordance with an embodiment of the present invention.

[0017] Fig. 3 depicts the supporting foot having a certain length exposed in accordance with an embodiment of the present invention.

[0018] Fig. 4 depicts the supporting foot having a minimum length exposed in accordance with an embodiment of the present invention.

[0019] Fig. 5 depicts a damping wheel separating from a side of a supporting foot in accordance with an embodiment of the present invention.

[0020] Fig. 6 depicts a separating apparatus in accordance with another embodiment of the present invention.

[0021] Fig. 7 depicts the separating apparatus driving the damping wheel to separate from a side of the supporting foot in accordance with another embodiment of the present invention.

[0022] Fig. 8 depicts a separating apparatus in accordance with a further embodiment of the present invention.

[0023] Fig. 9 depicts the separating apparatus driving the damping wheel to separate from a side of the supporting foot in accordance with a further embodiment of the present invention.

Detailed Description

[0024] The present invention provides an adjustable support frame for adjusting a height of the image output apparatus. The image output apparatus described herein may be a projector, a bioscope, an epidiascope or similar apparatus.

[0025] Fig. 1(a) depicts an appearance of assembly of an embodiment with an image output apparatus **124** in accordance with the present invention. The support frame in accordance with the present invention is disposed at the front end **126** of the image output apparatus **124**. The support frame includes a supporting foot **104** and a separating apparatus **118**. Adjusting the length of the supporting foot **104** extending out of the housing **116** may change the height of the image output apparatus **124**.

[0026] Fig. 1(b) depicts a cross-sectional view dissected along line I - I of Fig. 1(a). The present invention includes a damping wheel **1023** coupled to the housing **116**, a supporting

foot **104** and a side **106** of the supporting foot **104**. The housing **116** may be a housing corresponding to a projector, a bioscope, or an epidiascope. The supporting foot **104** stands on the surface of an object (e.g. a desk). The damping wheel **1023** is allowed to rotate in only one direction. Here the damping wheel **1023** is allowed to rotate counterclockwise, and is forbidden to rotate clockwise. When the damping wheel **1023** pushes against a side **106** of the supporting foot **104** to form a positioning state, the supporting foot **104** is static to the housing **116**. When the housing **116** is pressed downward, the supporting foot **104** moves relative to the housing **116** for adjusting the height of the image output apparatus. According to this embodiment, the damping wheel **1023** may be a roller **1023**, and the side **106** of the supporting foot **104** may be a positioning surface **106**. The present invention further includes a coupling unit **102**. The damping wheel **1023** is rotatably coupled to the coupling unit **102**.

[0027] In this embodiment, the coupling unit **102** is coupled to and horizontally movable to the housing **116** by a first groove **1021**, a first sliding railway **103** and a first spring **108**, as shown in Fig. 1(b). The coupling unit **102** includes the first groove **1021**, and the housing **116** includes the first sliding railway **103**. The first groove **1021** meshes with the sliding railway **103** so that the coupling unit **102** is under control rather than comes off when sliding. The coupling unit **102** may include the first sliding railway **103**, and the housing **116** may include the first groove **1021** without departing from the spirit of the present invention. Additionally, when the coupling unit **102** horizontally moves relative to the housing **116**, the first spring **108** provides the coupling unit **102** with resilience.

[0028] In this embodiment, the supporting foot **104** is coupled to and vertically movable to the housing **116** by a second groove **1041**, a second sliding railway **105**, a sliding railway frame **1051** of the supporting foot **104** and a second spring **110**, as shown in Fig. 1(b). The supporting foot **104** includes the second groove **1041**, and the housing **116** includes the

second sliding railway **105** meshing with the second groove **1041**. The sliding railway frame **1051** corresponding to the supporting foot **104** is so provided that the supporting foot **104** is under control rather than comes off or shakes when sliding. The supporting foot **104** may include the second sliding railway **105**, and the housing **116** may include the second groove **1041** and the sliding railway frame **1051** without departing from the spirit of the present invention. Additionally, when the supporting foot **104** vertically moves relative to the housing **116**, the second spring **110** provides the supporting foot **104** with resilience.

[0029] Figure 1(c) depicts another embodiment of the positioning unit in accordance with the present invention. The damping wheel **1023c** is a gear **1023c**, and the side **106c** of the supporting foot **104** is a rack **106c** meshing with the gear **1023c**. Similarly, the gear **1023c** is allowed to rotate in only one direction. Here the gear **1023c** is allowed to rotate counterclockwise, and is forbidden to rotate clockwise.

[0030] Still referring to Fig. 1(b), the present invention further includes a separating apparatus **118**. In this embodiment, the separating apparatus **118** is movably disposed in the housing **116** by a sliding railway frame **119** corresponding to the separating apparatus **118**, as shown in Fig. 1(b). The first surface **112** of the separating apparatus **118** is located outside the housing **116**, and the second surface **114** is located inside the housing **116**. When a force is applied to the first surface **112**, the second surface **114** is made to upwards press the coupling unit **102** so that the damping wheel **1023** separates from the side **106** of the supporting foot **104**, as shown in Fig.5. In this embodiment, the separating apparatus **118** is wedge-shaped and moves vertically relative to the housing **116**. The separating apparatus **118** may turn the vertical force applied to the first surface **112** into a horizontal one. When the second surface **114** is made to upwardly press the coupling unit **102**, the coupling unit **102** moves horizontally rightwards relative to the housing **116**, and the damping wheel **1023** separates from a side **106** of the supporting foot **104**.

[0031] Fig. 2 depicts a supporting foot **104** in accordance with an embodiment of the present invention having a maximum length exposed. When no force is applied to the housing **116**, both the first spring **108** and the second spring **110** remain in an original state, and the damping wheel **1023** touches a side **106** of the supporting foot **104** at the top to form the positioning state. Then the housing **116** is located at the top, namely the supporting foot **104** has a maximum length exposed outside of the housing **116**.

[0032] Fig. 3 depicts the supporting foot **104** shortened to a certain length in accordance with an embodiment of the present invention having a certain length exposed. When a force is applied downwards to and vertically relative to the housing **116**, the second spring **110** becomes in a compressed state and the first spring **108** remains in the original state. Then the damping effect of the damping wheel **1023** cooperates with the side **106** of the supporting foot **104** to resist the resilience of the second spring **110**, forming the positioning state again at a certain height. Therefore the housing **116** moves downwards relative to the supporting foot **104**, namely the supporting foot **104** has less exposed length outside the housing **116**.

[0033] Fig. 4 depicts the supporting foot **104** shortened to the shortest in accordance with an embodiment of the present invention having a minimum length exposed. When a larger force is applied vertically to the housing **116**, the second spring **110** is compressed much more, while the first spring **108** still remains in the original state. The damping effect of the damping wheel **1023** cooperates with the side **106** of the supporting foot **104** to resist the resilience of the second spring **110**, forming the positioning state at the bottom. Therefore the housing **116** moves downwards most relative to the supporting foot **104**, namely the supporting foot **104** has a shortened length exposed outside the housing **116**.

[0034] Fig. 5 depicts a damping wheel **1023** separating from the a side **106** of a supporting foot **104** and returning from the state shown in Fig.4 to the state shown in Fig. 2, in

accordance with an embodiment of the present invention. As the housing **116** has moved to the bottom relative to the supporting foot **104** (as shown in Fig.4), the first surface **112** of the separating apparatus **118** would touch the supporting foot **104** if a force is further applied vertically downwards to the housing **116**. Therefore the first surface **112** suffers a vertical upward force and the second surface **114** touches the coupling unit **102**. According to the separating apparatus **118** of the embodiment, the vertical upward force applied to the first surface **112** is diverted to a horizontal one by the wedge-shaped structure of the separating apparatus **118**. Then the coupling unit **102** is pushed rightwards by the second surface **114** and the first spring **108** becomes compressed. Thus the damping wheel **1023** separates from a side **106** of the supporting foot **104** and the second spring **110** remains compressed this moment.

[0035] Once the damping wheel **1023** separates from the side **106** of the supporting foot **104**, as shown in Fig. 5, the supporting foot **104** may not be able to resist the resilience provided by the second spring **110**. Thus the second spring **110** tends to return to the original state and the housing **116** is forced to reach the top again. The first surface **112** of the separating apparatus thus no longer suffers a vertically upward force. And the first spring **108** no longer suffers a horizontal force and tends to return to the original state. Therefore the coupling unit **102** is pushed back. Then the damping wheel **1023** pushes against the side **106** of the supporting foot **104** at the top again to form the positioning state, and the supporting foot **104** is returned to the state shown in Fig. 2.

[0036] The separating process described above is achieved by adjusting the friction between the second surface **114** and the coupling unit **102** and elasticity coefficient corresponding to the first spring **108** and the second spring **110**. The friction and the elasticity coefficient are adjusted to ensure that the housing **116** is forced to reach the top again before the first spring **108** returning to the original state.

[0037] Fig. 6 and Fig. 7 depict a separating apparatus **618** and the corresponding operation in accordance with another embodiment of the present invention. The separating apparatus **618** includes a first separating unit **620**, a second separating unit **622**, a first surface **612**, a second surface **614**, a third surface **613** and a fourth surface **615**. The first separating unit **620** is movably disposed in the housing **116** by a sliding railway frame **619** of the separating apparatus **618**, as shown in Fig. 6. The second separating unit **622** is rotatably disposed in the housing **116** by an axle **628**.

[0038] When the housing **116** has moved to the bottom relative to the supporting foot **104**, the first surface **612** would touch the supporting foot **104** if a force is further applied vertically downwards to the housing **116**. Therefore the first surface **612** suffers a vertical upward force and the third surface **613** touches the fourth surface **615**. The second separating unit **622** is forced to rotate clockwise and the second surface **614** pushes the coupling unit **102** rightwards. Then the damping wheel **1023** separates from a side **106** of the supporting foot **104**. The second spring **110** still remains compressed this moment.

[0039] Once the damping wheel **1023** separates from the side **106** of the supporting foot **104**, as shown in Fig. 7, the supporting foot **104** may not be able to resist the resilience provided by the second spring **110**. The second spring **110** thus tends to return to the original state and obliges the housing **116** to reach the top again. The first surface **612** of the separating apparatus **618** no longer suffers a vertically upward force. And the first spring **108** no longer suffers a horizontal force and tends to return to the original state. Then the coupling unit **102** is pushed back. The damping wheel **1023** pushes against the side **106** of the supporting foot **104** at the top forming the positioning state again so that the supporting foot **104** returns to the state shown in Fig. 2.

[0040] The separating process described above is achieved by a torsion spring disposed in the axle **628** for cooperating with the first spring **108**, as well as by adjusting the elasticity

coefficient corresponding to the first spring **108** and the second spring **110**. The torsion spring and the adjusted elasticity coefficients may ensure that the housing **116** is obliged to reach the top again before the first spring **108** returns to the original state.

[0041] Fig. 8 and Fig. 9 depict a separating apparatus **818** and the corresponding operation in accordance with a further embodiment of the present invention. No surface of the separating apparatus **818** is located outside the housing **116**. The separating apparatus **818** includes a first separating unit **820** coupled to the coupling unit **102** and a second separating unit **822** coupled to the supporting foot **104**. The first separating unit **820** has a third surface **813**. The second separating unit **822** has a fourth surface **815**. When the housing **116** is pressed downward to make the third surface **813** touch the fourth surface **815**, the coupling unit **102** is pushed rightwards and the damping wheel **1023** separates from a side **106** of the supporting foot **104**. The separating process, referring to other embodiments of the separating apparatus mentioned above, is achieved by adjusting the friction between the first groove **1021** and the first slide railway **103** and elasticity coefficient corresponding to the first spring **108** and the second spring **110**. The friction and the elasticity coefficient are adjusted to ensure that the housing **116** is obliged to reach the top again before the first spring **108** returns to the original state.

[0042] While this invention has been described with reference to the illustrative embodiments, these descriptions are not is intended to be construed in a limiting sense. Those skilled in the art may be able to make modification or alternation of these embodiments, which do not depart from the spirit and scope of the present invention. For instance, different positioning units, coupling units or separating apparatuses may be provided. Various modifications of the illustrative embodiments, as well as other embodiments of the invention, will be apparent upon reference to these descriptions. It is

therefore contemplated that the appended claims will cover any such modifications or embodiments as falling within the true scope of the invention and its legal equivalents.